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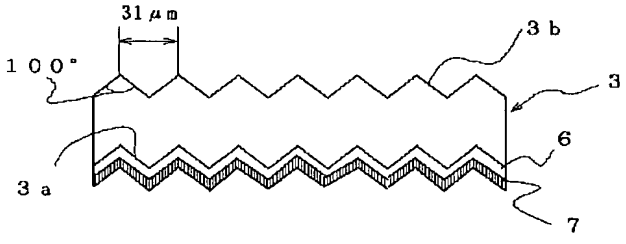
(54)【発明の名称】　平面蛍光ランプ

(57)【要約】

【目的】　平面蛍光ランプに関し、出射光の指向性を高められるようにした平面螢光ランプを提供することを目的とする。

【構成】　この発明の平面蛍光ランプは、前面ガラスパネルの内面に蛍光膜が形成された平面蛍光ランプにおいて、前面ガラスパネル３の外面側３ｂをプリズム状に形成したことを特徴とする。



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【特許請求の範囲】

【請求項１】　前面ガラスパネルの内面に蛍光膜が形成された平面蛍光ランプにおいて、前記前面ガラスパネルの外面側をプリズム状に形成したことを特徴とする平面蛍光ランプ。

【請求項２】　前面ガラスパネルの内面側をプリズム状に形成したことを特徴とする請求項１記載の平面蛍光ランプ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、例えば液晶表示装置の背面光源として使用される平面蛍光ランプに係り、特にランプ前面に対し法線方向の光が増幅されるようにした平面蛍光ランプに関する。

【０００２】

【従来の技術】従来の平面蛍光ランプは、例えば、図４の斜視図及び図５の断面図に示すように、前面ガラスパネル３、枠ガラス４及び背面ガラスパネル５をフリットガラスで互いに接着した密閉容器を備える。

【０００３】前面ガラスパネル３の内面側には順に蛍光体６とアノード７を構成するメタルバック層が積層される。このアノード７は、例えばアルミニウムなどの導電体を蒸着、スパッタリング、イオンプレーティングなどの薄膜形成法により付着させたものであり、リード８を介して高圧を印加できるようにしてある。

【０００４】密閉容器１内の空間には、電子ビームを制御するためのメッシュ状の制御電極９、１０が平行に配置され、これら制御電極９、１０はフリットガラス１１により枠ガラス４に接着され固定されている。

【０００５】制御電極９、１０と背面ガラスパネル５との間には複数のライン状カソードからなるカソード群１２がばね性をもった導電性の支持部１３ａ、１３ｂにより一定の張力を与えることにより、たるまない様に支持されている。

【０００６】また、背面ガラスパネル５の内面にはカーボン等の導電性膜からなる背面電極１４が形成されている。

【０００７】この平面蛍光ランプにおいては、カソード群１２に導通リード部１５ａ、１５ｂ及び導電性の支持部１３ａ、１３ｂを通じて電圧が加えられ、ヒータで暖められて電子ビームが発せられる。この電子ビームは背面電極１４により均一化され、カソード群１２の上部に設けられた制御電極９、１０により制御されると共に、前面ガラスパネル３のアノード７に印加された高圧により加速されて蛍光体６に突入し、蛍光体６を励起発光させる。

【０００８】

【発明が解決しようとする課題】この従来の平面蛍光ランプの蛍光体６の発光により出射される光は拡散光であり、指向性がない。このため、液晶パネルの背面光源のように所定の狭い角度範囲の光が要求される場合には、他の方向に向かう光は不要になるので、効率が悪い。また蛍光体６が平面であるため、蛍光体６の表面積を大きくとることに限界があり、発光量を高めて効率を高める上で不利である。

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【０００９】本発明に係る平面蛍光ランプは、上記の事情を鑑みてなされたものであり、出射光の指向性を高められるようにした平面蛍光ランプを提供することを目的とする。

【００１０】

【課題を解決するための手段】本発明の平面蛍光ランプは、前面ガラスパネルの内面に蛍光膜が形成された平面蛍光ランプにおいて、前記前面ガラスパネルの外面側をプリズム状に形成したことを特徴とする。

【００１１】更に、上記の目的を達成するため、前面ガラスパネルの内面側をプリズム状に形成するとよい。

【００１２】

【作用】前面ガラスパネルの外面側をプリズム状に加工することにより、前面ガラスパネルの外面に到達した光のうち、外面に対して一定の臨界角以内の入射角で入射する光は外面で屈折して前面ガラスの前面に対して法線方向あるいはそれに近い角度で出射するが、外面に対する入射角が臨界角を上回ると光は外面で前面ガラス内に全反射し、前面ガラスの内面あるいは蛍光体で再び反射する。そして、前面ガラスの両面で反射を繰り返す内に外面に対して臨界角以内の入射角で入射するようになると前面ガラスの前方に出射する。

【００１３】更に、前面ガラスの内面側をプリズム状に加工すれば、この内面に形成される蛍光体の表面積を平面状の内面の場合よりも大きくできる。

【００１４】

【実施例】本発明の一実施例に係る平面蛍光ランプを図面に基づいて具体的に説明すれば、以下の通りである。

【００１５】図１の模式図に示すように、この平面蛍光ランプの前面ガラスパネル３の外面３ｂと内面３ａとがプリズム状に加工され、内面３ｂに順に蛍光体６とアノード７が従来例と同じ手法で積層される。

【００１６】この平面蛍光ランプにおいては、図２及び図３の説明図に示すように、前面ガラスパネル３の内面３ａ側から外面３ｂに入射する光のうち、その入射角θが所定の臨界角以内の光Ａは外面３ｂを透過し、ランプ前面に対して法線方向あるいはそれに近い方向に出射される。

【００１７】これに対して、前面ガラスパネル３の内面３ａ側から外面３ｂに入射する光のうち、その入射角θが所定の臨界角を上回る光Ｂは、外面３ｂで前面ガラスパネル３の内側に全反射し、他の外面３ｂや内面３ａでの反射を繰り返し、やがて、外面３ｂのいずれかの箇所に臨界角以内で入射するようになると、ランプ前面に対して法線方向あるいはそれに近い方向に出射される。即

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ち、図３の斜線部に示すように、ランプ前面に対して法線方向あるいはそれに近い方向に出射される。また、前記前面ガラスパネルの内面３ａをプリズムに形成することにより、外面３ｂで反射された光は内面３ａで大きく乱反射するため、外面３ｂに対して臨界角以内の角度で再入射し、ランプ前面に対して法線方向あるいはそれに近い方向に出射される光が多くなる。

【００１８】また、この前面ガラスパネル３の内面３ａをプリズム状に形成することにより、その表面積が投影面積よりも大きくなり、その内面３ａに形成される蛍光体２の表面積も大きくなる。したがって、電子の突入によって発光できる発光面積が大きくなり、発光効率を高めることができる。

【００１９】この平面蛍光ランプのその他の構成、作用ないし効果は、上記の従来例と同様であるで、重複を避けるため、これらの説明は省略する。

【００２０】

【発明の効果】以上に説明したように、本発明の平面蛍光ランプによれば、前面ガラスパネルの外面をプリズム状に形成することにより、ランプ前面に対し法線方向に出射する光が増大して指向性が高められ、液晶表示装置の背景光源のように、指向性が必要とされる光源として最適の平面蛍光ランプが得られる。

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【００２１】更に、前面ガラスパネルの内面をプリズム状に形成することにより、内面の投影面積よりも内面及び内面に形成される蛍光体６の面積を大きくすることができ、蛍光体の発光効率を高めることができる。

【図面の簡単な説明】

【図１】本発明の一実施例の前面ガラスパネルの模式図である。

【図２】本発明の平面蛍光ランプの光路説明図である。

【図３】本発明の出射光の出射方向の分布を示す説明図である。

【図４】本発明の前提となる従来例の斜視図である。

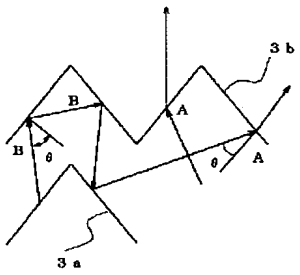
【図５】本発明の前提となる従来例の断面図である。

【符号の説明】

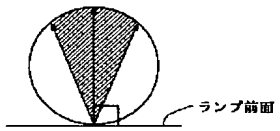
３　前面パネル
３ａ　内面
３ｂ　外面
５　背面パネル
６　蛍光体
７　アノード
９、１０　メッシュ状電極
１２　カソード群
１４　背面電極

【図１】

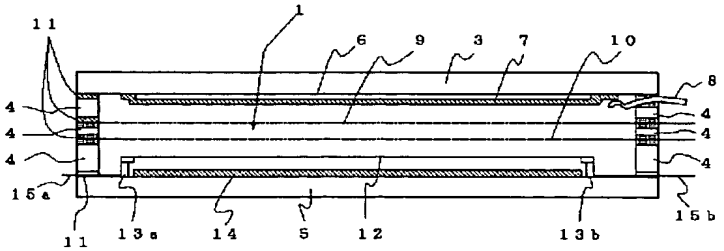
【図２】



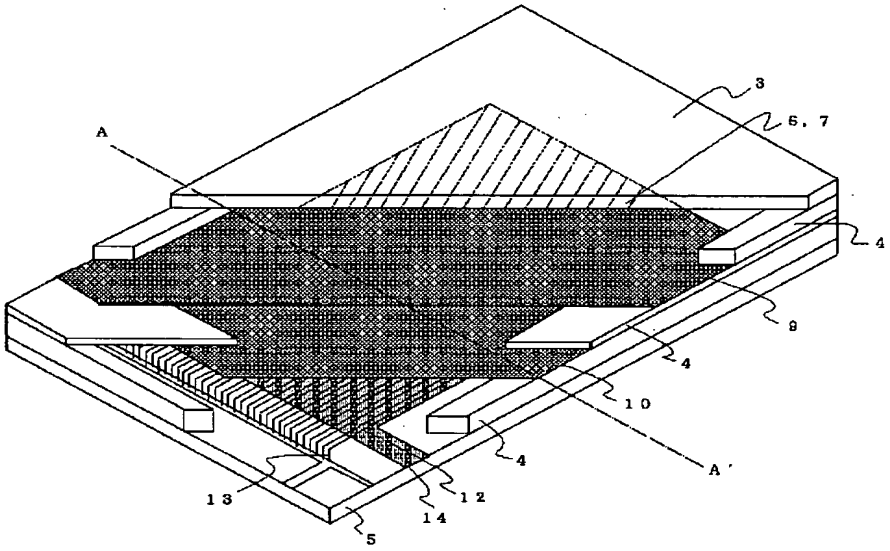
【図３】



【図５】



【図４】



PATENT ABSTRACTS OF JAPAN

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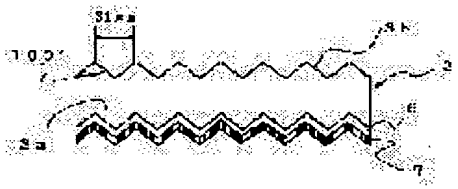
HAMAGISHI GORO

(54) FLAT FORM FLUORESCENT LAMP

(57)Abstract:
PURPOSE: To enhance the directivity of the emitted light and improve the light emitting efficiency of a fluorescent substance by embodying the outside and inside of a front glass panel in the form of a prism.
CONSTITUTION: The outside 3b and inside 3a of a front glass panel 3 are processed into the form of a prism, and a fluorescent substance 6 and anode 7 are laminated on the inside surface 3a. Of those beams of light incident to the surface 3b from the surface 3a, the beams incident to the surface 3b at an angle within a certain critical value penetrate the surface 3b to be emitted in the normal direction or near it relative to the front surface of the panel 3. When the angle of ioncidence to the surface 3b exceeds the critical value, the light is total reflected by the surface 3b in the panel 3, reflected repeatedly by the surfaces 3a, 3b, and emitted in the certain direction when it becomes incident to the surface 3b within the critical angle. Because the surface 3a is processed in the form of prism, the surfaces of the fluorescent substance 6 can be enlarged. This increases the emission light in the normal direction to the lamp front surface, improves the directionality, and enhances the light emitting efficiency of the fluorescent substance 6.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The flat-surface fluorescent lamp characterized by forming the external surface side of said front-windshield panel in the shape of prism in the flat-surface fluorescent lamp with which the fluorescent screen was formed in the inside of a front-windshield panel.
[Claim 2] The flat-surface fluorescent lamp according to claim 1 characterized by forming the inside side of a front-windshield panel in the shape of prism.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the flat-surface fluorescent lamp with which the flat-surface fluorescent lamp used as the tooth-back light source of a liquid crystal display is started, especially the light of the direction of a normal was amplified to the front face of a lamp.
[0002]
[Description of the Prior Art] The conventional flat-surface fluorescent lamp is equipped with the well-closed container on which the front-windshield panel 3, frame glass 4, and the tooth-back glass panel 5 of each other were pasted up with frit glass as shown in the perspective view of drawing 4 , and the sectional view of drawing 5 .
[0003] The laminating of the metal back layer which constitutes a fluorescent substance 6 and an anode 7 in order is carried out to the inside side of the front-windshield panel 3. This anode 7 makes conductors, such as aluminum, adhere by the thin film forming methods, such as vacuum evaporationo, sputtering, and ion plating, and enables it to have impressed high pressure through the lead 8.
[0004] The control electrodes 9 and 10 of the shape of a mesh for controlling an electron beam are arranged in parallel, frame glass 4 is pasted with frit glass 11, and these control electrodes 9 and 10 are being fixed to the space in a well-closed container 1.
[0005] It is supported by the appearance not curtaining by giving fixed tension with the conductive supporters 13a and 13b with which the cathode group 12 which consists of two or more Rhine-like cathodes had spring nature between control electrodes 9 and 10 and the tooth-back glass panel 5.
[0006] Moreover, the back plate 14 which consists of conductive film, such as carbon, is formed in the inside of the tooth-back glass panel 5.
[0007] In this flat-surface fluorescent lamp, an electrical potential difference is applied to the cathode group 12 through the flow lead sections 15a and 15b and the conductive supporters 13a and 13b, it is warmed by the heater, and an electron beam is emitted. It is equalized with a back plate 14, and it is accelerated with the high pressure impressed to the anode 7 of the front-windshield panel 3, and this electron beam rushes into a fluorescent substance 6, and carries out excitation luminescence of the fluorescent substance 6 while it is controlled by the control electrodes 9 and 10 prepared in the upper part of the cathode group 12.
[0008]
[Problem(s) to be Solved by the Invention] The light in which outgoing radiation is carried out by luminescence of the fluorescent substance 6 of this conventional flat-surface fluorescent lamp is the diffused light, and does not have directivity. For this reason, since the light which goes in other directions becomes unnecessary when the light of the narrow predetermined include-angle range is required like the tooth-back light source of a liquid crystal panel, effectiveness is bad. Moreover, since a fluorescent substance 6 is a flat surface, it is disadvantageous, when a limitation is to take the large surface area of a fluorescent substance 6, the amount of luminescence is raised and effectiveness is raised.
[0009] The flat-surface fluorescent lamp concerning this invention is made in view of the above-mentioned situation, and aims at offering the flat-surface fluorescent lamp it was made to have the

directivity of outgoing radiation light raised.
[0010]
[Means for Solving the Problem] The flat-surface fluorescent lamp of this invention is characterized by forming the external surface side of said front-windshield panel in the shape of prism in the flat-surface fluorescent lamp with which the fluorescent screen was formed in the inside of a front-windshield panel.
[0011] Furthermore, in order to attain the above-mentioned purpose, it is good to form the inside side of a front-windshield panel in the shape of prism.
[0012]
[Function] Although the light which carries out incidence by the incident angle within a fixed critical angle to external surface among the light which arrived at the external surface of a front-windshield panel by processing the external surface side of a front-windshield panel in the shape of prism is refracted outside and carries out outgoing radiation at the direction of a normal, or the include angle near it to the front face of a front windshield, if the incident angle over external surface exceeds a critical angle, outside, in a front windshield, total reflection of the light will be carried out and it will be again reflected with the inside or the fluorescent substance of a front windshield. And if it comes to carry out incidence by the incident angle within a critical angle to external surface while repeating reflection by both sides of a front windshield, outgoing radiation will be carried out ahead [of a front windshield].
[0013] Furthermore, if the inside side of a front windshield is processed in the shape of prism, surface area of the fluorescent substance formed in this inside can be made larger than the case of a plane inside.
[0014]
[Example] It will be as follows if the flat-surface fluorescent lamp concerning one example of this invention is concretely explained based on a drawing.
[0015] As shown in the mimetic diagram of drawing 1 , outside 3b and inside 3a of the front-windshield panel 3 of this flat-surface fluorescent lamp are processed in the shape of prism, and a laminating is carried out to inside 3b at order by the technique as the conventional example in which a fluorescent substance 6 and an anode 7 are the same.
[0016] In this flat-surface fluorescent lamp, as shown in the explanatory view of drawing 2 and drawing 3 , among the light which carries out incidence to outside 3b from the inside 3a side of the front-windshield panel 3, as for the light A within a predetermined critical angle, that incident angle theta penetrates outside 3b, and outgoing radiation is carried out in the direction of a normal, or the direction near it to the front face of a lamp.
[0017] On the other hand, the light B in which the incident angle theta exceeds a predetermined critical angle among the light which carries out incidence to outside 3b from the inside 3a side of the front-windshield panel 3 Total reflection is carried out inside the front-windshield panel 3 by outside 3b, reflection by other outside 3b and inside 3a is repeated, and soon, if it comes to carry out incidence to one part of the outside 3b within a critical angle, outgoing radiation will be carried out in the direction of a normal, or the direction near it to the front face of a lamp. Namely, as shown in the slash section of drawing 3 , outgoing radiation is carried out in the direction of a normal, or the direction near it to the front face of a lamp. Moreover, since the light reflected by outside 3b by forming inside 3a of said front-windshield panel in prism reflects irregularly greatly by inside 3a, it increases [the light by which outgoing radiation is carried out in the direction of a normal or the direction near it to reentry putting and the front face of a lamp less than at an angle of a critical angle to outside 3b].
[0018] Moreover, by forming inside 3a of this front-windshield panel 3 in the shape of prism, that surface area becomes larger than projected area, and the surface area of the fluorescent substance 2 formed in that inside 3a also becomes large. Therefore, the luminescence area which can emit light by electronic inrush becomes large, and can raise luminous efficiency.
[0019] these explanation is omitted, in order [that the configuration of others of this flat-surface fluorescent lamp, an operation, or effectiveness is the same as that of the above-mentioned conventional example] to come out and to avoid duplication.
[0020]

[Effect of the Invention] As explained above, according to the flat-surface fluorescent lamp of this invention, by forming the external surface of a front-windshield panel in the shape of prism, the light which carries out outgoing radiation in the direction of a normal to the front face of a lamp increases, directivity is raised, and the flat-surface fluorescent lamp optimal as the light source for which directivity is needed is obtained like the background light source of a liquid crystal display. [0021] Furthermore, by forming the inside of a front-windshield panel in the shape of prism, rather than the projected area of an inside, area of the fluorescent substance 6 formed in an inside and an inside can be enlarged, and the luminous efficiency of a fluorescent substance can be raised.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

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PRIOR ART

[Description of the Prior Art] The conventional flat-surface fluorescent lamp is equipped with the well-closed container on which the front-windshield panel 3, frame glass 4, and the tooth-back glass panel 5 of each other were pasted up with frit glass as shown in the perspective view of drawing 4 , and the sectional view of drawing 5 .
[0003] The laminating of the metal back layer which constitutes a fluorescent substance 6 and an anode 7 in order is carried out to the inside side of the front-windshield panel 3. This anode 7 makes conductors, such as aluminum, adhere by the thin film forming methods, such as vacuum evaporationo, sputtering, and ion plating, and enables it to have impressed high pressure through the lead 8.
[0004] The control electrodes 9 and 10 of the shape of a mesh for controlling an electron beam are arranged in parallel, frame glass 4 is pasted with frit glass 11, and these control electrodes 9 and 10 are being fixed to the space in a well-closed container 1.
[0005] It is supported by the appearance not curtaining by giving fixed tension with the conductive supporters 13a and 13b with which the cathode group 12 which consists of two or more Rhine-like cathodes had spring nature between control electrodes 9 and 10 and the tooth-back glass panel 5.
[0006] Moreover, the back plate 14 which consists of conductive film, such as carbon, is formed in the inside of the tooth-back glass panel 5.
[0007] In this flat-surface fluorescent lamp, an electrical potential difference is applied to the cathode group 12 through the flow lead sections 15a and 15b and the conductive supporters 13a and 13b, it is warmed by the heater, and an electron beam is emitted. It is equalized with a back plate 14, and it is accelerated with the high pressure impressed to the anode 7 of the front-windshield panel 3, and this electron beam rushes into a fluorescent substance 6, and carries out excitation luminescence of the fluorescent substance 6 while it is controlled by the control electrodes 9 and 10 prepared in the upper part of the cathode group 12.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the flat-surface fluorescent lamp of this invention, by forming the external surface of a front-windshield panel in the shape of prism, the light which carries out outgoing radiation in the direction of a normal to the front face of a lamp increases, directivity is raised, and the flat-surface fluorescent lamp optimal as the light source for which directivity is needed is obtained like the background light source of a liquid crystal display.
[0021] Furthermore, by forming the inside of a front-windshield panel in the shape of prism, rather than the projected area of an inside, area of the fluorescent substance 6 formed in an inside and an inside can be enlarged, and the luminous efficiency of a fluorescent substance can be raised.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The light in which outgoing radiation is carried out by luminescence of the fluorescent substance 6 of this conventional flat-surface fluorescent lamp is the diffused light, and does not have directivity. For this reason, since the light which goes in other directions becomes unnecessary when the light of the narrow predetermined include-angle range is required like the tooth-back light source of a liquid crystal panel, effectiveness is bad. Moreover, since a fluorescent substance 6 is a flat surface, it is disadvantageous, when a limitation is to take the large surface area of a fluorescent substance 6, the amount of luminescence is raised and effectiveness is raised.
[0009] The flat-surface fluorescent lamp concerning this invention is made in view of the above-mentioned situation, and aims at offering the flat-surface fluorescent lamp it was made to have the directivity of outgoing radiation light raised.

[Translation done.]

MEANS

[Means for Solving the Problem] The flat-surface fluorescent lamp of this invention is characterized by forming the external surface side of said front-windshield panel in the shape of prism in the flat-surface fluorescent lamp with which the fluorescent screen was formed in the inside of a front-windshield panel.
[0011] Furthermore, in order to attain the above-mentioned purpose, it is good to form the inside side of a front-windshield panel in the shape of prism.

[Translation done.]

OPERATION

[Function] Although the light which carries out incidence by the incident angle within a fixed critical angle to external surface among the light which arrived at the external surface of a front-windshield panel by processing the external surface side of a front-windshield panel in the shape of prism is refracted outside and carries out outgoing radiation at the direction of a normal, or the include angle near it to the front face of a front windshield, if the incident angle over external surface exceeds a critical angle, outside, in a front windshield, total reflection of the light will be carried out and it will be again reflected with the inside or the fluorescent substance of a front windshield. And if it comes to carry out incidence by the incident angle within a critical angle to external surface while repeating reflection by both sides of a front windshield, outgoing radiation will be carried out ahead [of a front windshield].
[0013] Furthermore, if the inside side of a front windshield is processed in the shape of prism, surface area of the fluorescent substance formed in this inside can be made larger than the case of a plane inside.

EXAMPLE

[Example] It will be as follows if the flat-surface fluorescent lamp concerning one example of this invention is concretely explained based on a drawing.
[0015] As shown in the mimetic diagram of drawing 1 , outside 3b and inside 3a of the front-windshield panel 3 of this flat-surface fluorescent lamp are processed in the shape of prism, and a laminating is carried out to inside 3b at order by the technique as the conventional example in which a fluorescent substance 6 and an anode 7 are the same.
[0016] In this flat-surface fluorescent lamp, as shown in the explanatory view of drawing 2 and drawing 3 , among the light which carries out incidence to outside 3b from the inside 3a side of the front-windshield panel 3, as for the light A within a predetermined critical angle, that incident angle theta penetrates outside 3b, and outgoing radiation is carried out in the direction of a normal, or the direction near it to the front face of a lamp.
[0017] On the other hand, the light B in which the incident angle theta exceeds a predetermined critical angle among the light which carries out incidence to outside 3b from the inside 3a side of the front-windshield panel 3 Total reflection is carried out inside the front-windshield panel 3 by outside 3b, reflection by other outside 3b and inside 3a is repeated, and soon, if it comes to carry out incidence to one part of the outside 3b within a critical angle, outgoing radiation will be carried out in the direction of a normal, or the direction near it to the front face of a lamp. Namely, as shown in the slash section of drawing 3 , outgoing radiation is carried out in the direction of a normal, or the direction near it to the front face of a lamp. Moreover, since the light reflected by outside 3b by forming inside 3a of said front-windshield panel in prism reflects irregularly greatly by inside 3a, it increases [the light by which outgoing radiation is carried out in the direction of a normal or the direction near it to reentry putting and the front face of a lamp less than at an angle of a critical angle to outside 3b].
[0018] Moreover, by forming inside 3a of this front-windshield panel 3 in the shape of prism, that surface area becomes larger than projected area, and the surface area of the fluorescent substance 2 formed in that inside 3a also becomes large. Therefore, the luminescence area which can emit light by electronic inrush becomes large, and can raise luminous efficiency.
[0019] these explanation is omitted, in order [that the configuration of others of this flat-surface fluorescent lamp, an operation, or effectiveness is the same as that of the above-mentioned conventional example] to come out and to avoid duplication.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram of the front-windshield panel of one example of this invention.

[Drawing 2] It is the optical-path explanatory view of the flat-surface fluorescent lamp of this invention.
[Drawing 3] It is the explanatory view showing distribution of the direction of outgoing radiation of the outgoing radiation light of this invention.
[Drawing 4] It is the perspective view of the conventional example which will be the requisite for this invention.
[Drawing 5] It is the sectional view of the conventional example which will be the requisite for this invention.
[Description of Notations]
3 Front Panel
3a Inside
3b External surface
5 Back Panel
6 Fluorescent Substance
7 Anode
9 Ten Mesh-like electrode
12 Cathode Group
14 Back Plate

[Translation done.]